# Line Charge Manufacturing Technology Implementation of Overbraiding Technology for the Anti-Personal Obstacle Breaching System (APOBS)

### PROBLEM / OBJECTIVE

The United States Marine Corps and the United States Army have requirements to breach pathways through obstacles and minefields for the rapid advancement of troops. Present fielded systems include the Mine Clearing Line Charge (MICLIC) and the Bangalore Torpedo. New systems are being developed to address the present systems shortcomings, such as the Anti-Personnel Obstacle Breaching System (APOBS). The line charge assembly of the APOBS, baseline design, consisted of front (25 meters in length) and back (20 meters in length) line charge segments containing a total of 108 grenades. The grenades were connected with detonation cord and two nylon rope strength members, which run parallel to the detonation cord and were connected to each grenade with two band clamps. The process of attaching the ropes to the grenades with the band clamps was a labor-intensive operation and a reliability concern. Testing during the development phase indicated the potential problem of band clamps and/or rope breaking during deployment.

The objective of this project was to develop and demonstrate an alternate grenade attachment approach for APOBS that improved the manufacturing process of the line charge assembly. A process was sought that lent itself to automation, was operator independent, and hence, produced a more reliable product.

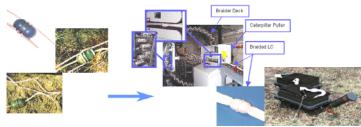
#### **ACCOMPLISHMENTS / PAYOFF**

## **Process Improvement:**

The overbraid design resulted in a reduction of attachment components from 5 to 1 and eliminated the sharp edges of the band clamp design. It is also more process insensitive than the original baseline clamp design. The results of static testing conducted on the overbraid design indicated an increase in strength member strength from 3200 to 4000 pounds and an increase in grenade slip force from 650 to over 2600 pounds. Functional testing of line charge segments indicated similar fragmentation pattern and similar performance as the baseline design in defeating the triple strand concertina wire obstacle.

#### Implementation and Technology Transfer:

The Ensign-Bickford Company (EBCo) was awarded the Marine Corps contract to develop, first article test, and eventually go into production with the APOBS. EBCo conducted tests to evaluate both their MANTECH developed grenade attachment concept and the braided design and selected the overbraid approach. The overbraid technology transfer was initiated using a teaming arrangement, in which, Indian Head Division braided the EBCo supplied



Overbraided APOBS

hardware pre-assemblies. Based on the results of EBCo conducted tests, and producibility concerns, the braided design was selected for the manufacture of their First Article Test (FAT) samples. To complete the technology transfer, Indian Head representatives assisted EBCo in setting-up a braiding facility and ensuring that it produced an acceptable product. EBCo produced 28 APOBS for FAT, which were successfully subjected to a full range of insensitive munition, environmental and functional tests. Seventy-five systems were produced for Pre-Production Operational Testing prior to production. EBCo has now fully implemented the overbraid technology. They have delivered 7225 systems with 300 to go under the current contract.

## **Expected Benefits:**

The benefits from this project are weight savings, increased reliability, cost avoidance, a reduction in the quantity of components for the line charge assembly, and hence, improved producibility. The braiding process developed within this project is directly applicable to any line charge or net array system that incorporate discrete point masses of explosives.

## TIME LINE / MILESTONE

Start Date: May 1997 End Date: December 2000

#### **FUNDING**

Navy ManTech: \$3.2M

### **PARTICIPANTS**

Naval Surface Warfare Center - Indian Head Division Navy Energetics Manufacturing Technology Center The Ensign-Bickford Company Primex Technologies Tracor Aerospace, Inc.